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ANTONELLI TERRY STOUT AND KRAUS
SUITE 1800
1300 NORTH SEVENTEENTH STREET
ARLINGTON, VA 22209

EXAMINER
MALSAWMA, LALRINFAMKIM HMAR

ART UNIT	PAPER NUMBER
2825	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/902,673	FUNABASHI, MICHIMASA	
	Examiner	Art Unit	
	Lex Malsawma	2825	

-- Th MAILING DATE of this communication appears on the cover sh t with th correspond nc address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 April 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *20-30 and 32-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *20-30 and 32-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. *09/392,568* .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on April 29, 2003 has been entered.

2. It is noted that the amendments after FINAL were not entered and Applicant did not elect, in the RCE transmittal (Paper No. 13), to submit those amendments for consideration. Accordingly, Claim 31 has NOT been canceled and Claim 33 has not been entered; therefore, Claims 20-32 and 34-37 are currently pending.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 20-23, 25-27, 34-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmi et al. (5,990,060, hereinafter, "Ohmi") in view of Wang (6,087,243).

Regarding Claims 20-23, 25, and 27:

Ohmi discloses the following:

a processing solution containing hydrogen peroxide, hydracid fluoride salt (e.g., tetraalkyl ammonium fluoride), and water (note TABLE 1, in col. 9);

the processing solution includes HF and HF_2^- as etching seeds of silicon oxide (note col. 2, lines 32-34);

the processing solution can be used with ultrasonic vibration during the cleaning of a silicon wafer (note col. 3, line 67 to col. 4, line 44);

the processing solution can be used to clean the silicon wafer at a temperature as low as 40 °C (note col. 5, lines 7-16);

the processing solution is used to remove foreign materials deposited on a substrate after photoresist, for ion injection or reactive ion etching, is removed (note col. 2, lines 7-13); and

a method of utilizing the processing solution comprising:

(a) providing a silicon wafer 3 covered with an insulating film 3 whose main surface is mainly formed of silicon oxide 4 (note Figs. 3), wherein the surface contains foreign material 6 from a previous step of removing a photoresist (note Fig. 5); and

(b) cleaning the surface of said silicon wafer ***covered with said insulating film whose main surface is mainly formed of silicon oxide (note in Figs. 5-6, the foreign material "6" is cleaned from silicon oxide 4, wherein the silicon oxide 4 covers the silicon wafer 3)*** with said processing solution such that the foreign material 6 is removed from the mainly silicon oxide surface (Fig. 6).

Ohmi **lacks** the following:

(1) specifying the concentration of said hydracid fluoride salt in units of mol/L, i.e., specifying the concentration in terms of molarity;

(2) the device manufacturing process step (c) of removing the insulating film after the step (b) of cleaning to expose the surface to the silicon wafer; and

(3) the device manufacturing process step (d) of subjecting the silicon wafer to a heat-treatment after step (c) thereby to form a gate oxide film over the silicon wafer.

In regards to lacked-limitation (1), Ohmi specifies the density of ammonium fluoride (i.e., the hydracid fluoride salt) is in a range of 0.05 to 49 weight % (note the sentence bridging cols. 2-3), and if tetra-methyl ammonium fluoride is used for the hydracid fluoride salt, then the density is in the range of 0.05 to 60 weight %. In other words, if ammonium fluoride (NH_4F, formula weight = 37 grams, i.e., 1 mole of NH_4F weighs 37 grams) is used as the hydracid fluoride salt, and if the density specified by Ohmi is interpreted in grams/liter (g/L), then Ohmi could be interpreted as specifying a range of 0.05 to 49 grams per liter (i.e., a range of 0.05g/L to 49g/L of NH_4F), which would convert to a range in molarity of about 0.0013 *M* to 1.324 *M* (i.e., a range of 0.0013 mol/L to 1.324 mol/L of NH_4F). It is noted that no specific hydracid fluoride salt is specified in Claim 20, therefore, the claimed range in molarity (i.e., 0.1 to 3 mol/L) is in the very least held obvious over Ohmi, since Ohmi could be interpreted as disclosing a molarity within the claimed range. In any case, Ohmi discloses the general conditions for the processing solution with similar concentrations for the hydracid fluoride salt, and it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. Therefore, lacked-limitation (1) is not considered to have patentable weight because Ohmi's disclosure could include concentrations within the claimed range.

In regards to lacked-limitations (2) and (3), it important to note that Ohmi does not disclose, or is not specifically concerned with disclosing, process steps for forming any particular device, but rather, Ohmi discloses only process steps (or conditions) necessary to clean a substrate utilizing the processing solution. In other words, Ohmi discloses an important aspect of the current invention, i.e., a processing solution which contains hydrogen peroxide, hydracid fluoride salt, and water; and Ohmi discloses only pertinent steps for utilizing the processing solution in a cleaning process, wherein the cleaning process would be just one process out of a plurality of processes that would be required during semiconductor device fabrication, for example, other processes such as an ion-implantation process, a metallization process, a via forming process, etc. would also be necessary in a semiconductor device fabrication. Wang is cited to show processes that would typically be included in a semiconductor device fabrication. Wang **teaches** (in col. 2, lines 12-41) a pad oxide layer (i.e., a sacrificial oxide layer) is first formed on a surface of a substrate; various process steps are then performed, including an ion implantation step to form a retrograde well (note col. 2, lines 30-31); then remaining portions of the pad/sacrificial oxide layer is then removed (col. 2, lines 36-37); and after removal of said remaining portions, a gate oxide film is grown over the silicon wafer, wherein the gate oxide would most probably be thermally grown (note col. 2, lines 38-40) as is common in the art. The following important note is necessary at this point:

> In regards to Wang's disclosure of performing an ion implantation step (to form a retrograde well) prior to removing the remaining pad/sacrificial oxide, one of ordinary skill in the art would have realized that the ion implantation step would be performed by utilizing a resist pattern which is later removed, even though Wang does not specifically

disclose the steps for the ion-implantation process. For example, note Ohmi's disclosure in col. 5 (lines 41-50), "[r]esist is always required from the photolithographic process to the next ion implantation process...". One of ordinary skill in the art would realize that numerous resist patterning and removal steps are generally required during device fabrication, wherein according to Ohmi's disclosure, the cleaning solution (and process of cleaning) would be utilized at least after one resist-pattern-removal step, more specifically, Ohmi would be applied after removing a resist pattern which had been formed on top of a silicon oxide layer (note again, Ohmi's Figs. 3-6).

Returning to Wang, in Figs. 1A-1D and col. 6 (line 19) to col. 7 (line 25), a specific device manufacturing process is disclosed, and initially, it is noted that this process is very similar to the process disclosed in the current specification (see Figs. 3-8, 10, and 11 of Applicants' drawings). The point being made is that both Wang and Applicant are utilizing the common practice of:

(i) forming a pad/sacrificial oxide on a silicon wafer;

(ii) performing various processing steps including an ion implantation step "utilizing a resist mask" to form a well, wherein the resist mask is formed directly on the pad/sacrificial oxide layer;

(iii) removing the resist mask which was formed on the pad/sacrificial oxide;

(iv) removing portions of the pad/sacrificial oxide layer; and

(v) growing a gate oxide film over the silicon wafer.

In regards to the instant claims, the issue of patentability rests on whether or not it would have obvious to one of ordinary skill in the art to utilize Ohmi's processing solution (and cleaning process) to clean the silicon wafer after step (iii) but before step (iv) of said common practice.

Ohmi teaches the processing solution (and cleaning process) was invented for the very purpose of removing foreign material remaining on the surface of a silicon oxide layer (i.e., a pad/sacrificial oxide surface), wherein the foreign material is a direct result of removing a resist mask which had been formed on the silicon oxide surface. Ohmi discloses in "Background Technology", cols. 1-2) prior art problems associated with foreign materials remaining after resist removal; and in col. 2 (lines 8-20), col. 3 (lines 42-47), and col. 11 (lines 29-36), Ohmi discloses the advantages of cleaning a wafer surface utilizing the processing solution. Therefore, **it would have been obvious** to one of ordinary skill in the art to implement Ohmi into a typical semiconductor manufacturing process (similar to that shown by Wang), wherein Ohmi's processing solution (and cleaning process) is utilized after a step of removing a resist mask which had been formed on a pad/sacrificial oxide layer **because** problems caused by foreign materials (from the resist mask) remaining on the pad/sacrificial oxide surface can be avoided, since Ohmi's processing solution and cleaning process will remove the foreign materials with an additional advantage of being able to perform the cleaning process at a low temperature (note Ohmi, col. 1, lines 51-65, and col. 5, lines 7-10).

Regarding Claims 26 and 34:

Ohmi (in view of Wang) discloses the general conditions of the instant claim, however, Ohmi does not specify any particular range for pH. ***It is important to note Ohmi specifies that the cleaning solution is basic or at very least "shows alkalinity"(note col. 2, lines 27-39), i.e., an aqueous solution that shows alkalinity would generally be considered to have a pH greater than about 7. Although Ohmi does not specify a particular range for pH, one of ordinary skill in the art would have realized that Ohmi's disclosure is directed to a process solution having a***

pH of about 7 or greater, since the solution "shows alkalinity". It would have been obvious to one of ordinary skill in the art to specify a pH in a range of 6 to 11 for the processing solution ***because Ohmi indirectly indicates a pH range of about 7 or greater, and specifying a pH of 6 to 11 could be another way of indicating that the processing solution "shows alkalinity". In any case, it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges (i.e., ranges in pH) involves only routine skill in the art. In re Aller, 105 USPQ 233***.

Regarding Claims 35-37:

Ohmi discloses (in col. 2, lines 35-39) the processing solution is capable of etching silicon oxide and silicon. If the main surface is mainly formed of silicon oxide, it would be clearly obvious that the processing solution etches the silicon oxide but does not etch the silicon wafer. In other words, if the main surface is a layer of silicon oxide covering the entire silicon wafer, then the processing solution would obviously etch the silicon oxide without etching the silicon wafer. To clarify, note in Ohmi's Figs. 5-6, after the cleaning step, the silicon oxide layer 4 remains, therefore, if the entire surface of the silicon wafer 3 were to be covered by the silicon oxide layer 4 such that no portion of the silicon wafer 3 were exposed, as in a case of ion-implanting through a sacrificial oxide, it would be clearly obvious to one of ordinary skill in the art that the processing solution would etch only the silicon oxide layer 4, i.e., Ohmi shows that portions of the silicon wafer 3, which are covered by the silicon oxide 4 is not etched (or will not be etched) because the cleaning step does not completely remove the silicon oxide 4 even though the silicon oxide layer 4 would be etched to some extend (as specified in col. 2, lines 35-39). The instant claims are held obvious over the cited references

primarily because the limitations within these claims can be readily achieved by Ohmi's process and processing solution depending on a particular function/use of the silicon oxide layer 4, e.g., if the silicon oxide layer 4 were to be utilized as a sacrificial oxide during an ion-implantation process, as is common in the art, then no portion of silicon wafer 3 would be exposed during the "foreign material" cleaning step such that only the silicon oxide 4 will be etched during the cleaning step (note again, Figs. 5-6 of Ohmi).

5. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmi (in view of Wang) as applied to Claim 20 above, and further in view of Ohmi et al. (5,277,835, hereinafter, " '835 Patent").

Regarding Claim 24:

Ohmi (in view of Wang) **lacks** a surfactant being included in the processing solution. The '835 Patent **teaches** it was well known in the art to include a surfactant into a processing solution wherein the wettability of the processing solution can be improved such that smoothness of a surface being treated can be achieved during a cleaning step (note col. 1, line 62 to col. 2, line 52). It would have been obvious to one of ordinary skill in the art to modify Ohmi (in view of Wang) by including a surfactant because the '835 Patent teaches such a modification could ensure smoothness of a surface being cleaned by the processing solution.

6. Claims 28, 29, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmi (in view of Wang) as applied to Claim 20 above, and further in view of Okutani (5,135,608).

Regarding Claims 28 and 29:

Wang teaches the pad/sacrificial oxide layer is removed with dilute hydrofluoric acid (HF) prior to subjecting the substrate to the heat-treatment to form the gate oxide film (note col. 2, lines 36-40). However, Ohmi (in view of Wang) **lacks** specifically disclosing that the substrate is dried before forming the gate oxide by the heat-treatment step. One of ordinary skill in the art would have realized that, in a process as specified by Wang, a drying step would be performed before the heat-treatment step, and Okutani is cited to show that it was very well known in the art to thoroughly dry a substrate after a wet process. Okutani **teaches** (note Fig. 1 and abstract) a multi-module apparatus with an arrangement comprising a wet processing chamber and several dry processing chambers, wherein the arrangement allows dry processing and wet processing to be continuously effected without exposing the wafer to air (i.e., a contaminating atmosphere outside of the apparatus). Okutani teaches (col. 4, lines 27-41) that a wafer which has undergone wet processing is thoroughly dried before any subsequent dry processing is performed. It is important to note that Okutani's apparatus has the ideal features necessary for implementing Ohmi's cleaning solution/process and Wang's process into a semiconductor device manufacturing method. It would have been obvious to one of ordinary skill in the art to modify Ohmi (in view of Wang) by specifying a drying process prior to the heat-treatment because Okutani teaches it was well known in the art to thoroughly dry a substrate after a wet process and an apparatus having ideal features to perform such a drying process would have been available at the time the current invention was made.

Regarding Claim 30:

The apparatus disclosed by Okutani allows transportation of the substrate directly from one processing chamber (wet or dry processing) to another processing chamber without exposing the silicon wafer to (a contaminating) atmosphere. Furthermore, the apparatus includes means for immediately transferring a substrate to another processing chamber after a thorough drying process, therefore, the instant claim is held obvious over the cited references.

7. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmi (in view of Wang) as applied to Claim 20 above, and further in view of Hazama et al. (5,162,880) and Hwang (5,512,519).

Regarding Claim 32:

Ohmi (in view of Wang) **lack** performing another heat-treatment in an atmosphere of NO or N_2O to segregate nitrogen at the interface between the gate oxide and the silicon wafer. Hazama et al. **teach** a method of forming carrier traps in a gate oxide film, wherein the carrier traps can significantly improve performance of nonvolatile semiconductor memory cells (note abstract and col. 1, line 15 to col. 2, line 22). Hazama et al. teach the method comprises thermally oxidizing a substrate 11 to form a gate oxide film 14 (Fig. 5b and col. 4, lines 38-41) and performing another heat-treatment in a nitrogen atmosphere to form carrier traps 13 within the gate oxide, wherein the carrier traps are located at an interface between the gate oxide and the substrate (note Fig. 5c and col. 4, lines 54-57). Hazama et al. do not specify any particular source for generating the nitrogen atmosphere. Hwang is cited primarily to show it was very well known in the art to utilize either NO or N_2O in order to provide a nitrogen containing

atmosphere. Note Hwang discloses that nitrogen atoms are located at the Si/SiO_2 interface by conducting a heat-treatment in NO gas (col. 2, lines 64-67). It would have been an obvious matter of design choice for one of ordinary skill in the art to modify Ohmi (in view of Wang) by performing another heat-treatment in a nitrogen atmosphere utilizing either NO or N_2O because of the following reasons:

It was well known in the art to form a gate oxide layer comprising nitrogen atoms at the gate-oxide/substrate interface, wherein locating nitrogen atoms in such a manner can be achieved by a heat-treatment in NO or N_2O (as shown by Hwang);

it was well known in the art that heat treating a gate oxide layer in a nitrogen atmosphere can provide significant benefits to a particular type of semiconductor device (as taught by Hazama et al.);

performing another heat-treatment in a nitrogen containing atmosphere would depend largely on the particular type of semiconductor device being fabricated;

Applicant does not specifically claim any particular type of semiconductor device being fabricated; therefore,

incorporating another heat-treatment (as instantly claimed) would have been a matter of design choice, since such an incorporation would depend on a particular semiconductor device being fabricated or on a particular design need, wherein the benefits of such a heat-treatment were well known in the art (as taught/shown by Hazama et al.).

8. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmi (in view of Wang and Okutani) as applied to Claim 30 above, and further in view of Hazama et al. (5,162,880) and Hwang (5,512,519).

Regarding Claim 31:

This claim is similar to Claim 32, and in general, Ohmi (in view of Wang and Okutani) disclose the general conditions of the claimed invention except for performing another heat-treatment in an atmosphere of NO or N_2O. Hazama et al. and Hwang are cited to show it was well known in the art to subject a gate oxide layer to a heat-treatment in a nitrogen atmosphere (utilizing NO or N_2O). Therefore, with similar reasoning applied to Claim 32 above, the instant claim is held obvious over the cited references, i.e., it would have been an obvious matter of design choice to perform another heat-treatment (in a nitrogen atmosphere), since such a choice could depend primarily on a specific type of semiconductor device being fabricated.

Remarks

9. Applicant's remarks/arguments have been carefully reviewed and considered; however, they are not persuasive. Initially, in response to Applicant's remarks on page 16 (1st full paragraph), Examiner appreciates Applicant's thorough consideration of the Office action made Final (i.e., Paper No. 8). Applicant correctly points out that the Examiner has not applied Okutani in connection with claim 26. Okutani was unintentionally included when copying and pasting texts from various drafts of the Office action; even though Okutani was unintentionally included, it is clear from the claim language that Okutani's disclosure is not necessary; and as indicated in item "2" on page 2 of the Office action made Final (i.e., Paper No. 8), it would be

clear that claim 26 is held obvious over Ohmi et al. in view of Wang. Appropriate corrections have been made in this Office action.

Specifically regarding Applicant's arguments regarding the combinations of references, it is initially noted Ohmi et al. (5,990,060, hereinafter, Ohmi) disclose the processing solution will effectively clean debris located directly on an insulating film or directly located on a silicon wafer, i.e., the processing solution will effectively clean a main surface of a substrate wherein the main surface is an insulating film or a silicon wafer (note especially, Ohmi's Fig. 5 and Fig. 7, wherein debris "6" is located on either insulating film "4" or on silicon wafer "3"). Applicant submits that Ohmi is "concerned with a cleaning step after formation of a gate oxide film" (see page 9, lines 4-5); however, it is clear from at least the embodiment shown in Figs. 7-10 that Ohmi discloses the processing solution can be used in a cleaning step before any layers are formed (e.g., a gate oxide layer). Therefore, Applicant's remarks regarding Ohmi's disclosure is not persuasive.

Attention is directed to Wang's disclosure (6,087,243) for manufacturing a semiconductor integrated circuit device. Wang specifies a process sequence comprising:

forming an insulating film (i.e., a pad oxide, note col. 4, lines 26-30; and col. 3, lines 35-36);

cleaning the insulating film after performing various steps that include ion implantation (note col. 4, lines 30-31; and col. 3, lines 49-50);

removing the insulating film after the cleaning thereby to expose a surface of a silicon wafer (note col. 4, line 31-33; and col. 3, lines 50-52); and

after such removing, subjecting the silicon wafer to a heat treatment thereby to form a gate oxide film over the silicon wafer (note col. 4, lines 33-34; and col. 3, lines 60-62).

Keeping this process sequence in mind, attention is directed to Applicant's remarks (see the sentence bridging pages 12 and 13), wherein Applicant presents what seems to be the overlying basis for the arguments regarding the combinations of references. Applicant submits, "Wang initially removes the pad oxide film and thereafter performs a cleaning", and accordingly, a combination of Wang and Ohmi would teach away from a process wherein the cleaning of the surface using the process solution is performed, and thereafter the insulating film is removed and thereafter the gate oxide is formed (see page 12, last paragraph). Examiner agrees that Wang performs a cleaning step after removing the pad oxide, however, it is important to note Wang **also cleans** the pad oxide (i.e., the insulating film) **before** removing it (as clearly show above). Applicant's remarks/arguments are not persuasive primarily because they seem to be based on an assumption that Wang only discloses cleaning after removal of the insulating film (i.e., the pad oxide); and based on this assumption, it seems Applicant submits that Ohmi's processing solution, when incorporated/combined with Wang, would be utilized only after the insulating film is removed. However, it is clear from Wang's specified process sequence (note above) that *the insulating film is cleaned* after performing steps such as ion implantation but *before its removal*. Since Ohmi discloses the processing solution will effectively remove debris resulting from material (e.g., photoresist) utilized during processes such as ion implantation, it would be obvious to use Ohmi's processing solution when cleaning the insulating film (pad oxide) as specified by Wang, especially because Wang discloses that cleaning is performed at least after an

ion-implantation step; therefore, the combination of Ohmi and Wang does not teach away from the process sequence of the current invention.

In reference to Okutani, Hwang, and Hazama, Applicant seems to generally argue that these references, in combination with Ohmi and Wang, would not have disclosed nor would have suggested the sequencing of processing steps as recited in the current claimed invention. As explained in detail above, Wang discloses the sequencing of process steps as currently claimed. In summary, all pending claims are held obvious primarily because Ohmi discloses a critical aspect of the current invention (i.e., the processing solution), and given Wang's disclosure, one of ordinary skill in the art would have realized that Ohmi's processing solution would be an ideal cleaning solution to utilize during the cleaning steps specified by Wang.

Status of the Claims

10. Claims 20-32 and 34-37 are pending.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lex Malsawma whose telephone number is 703-306-5986.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 703-308-1323. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Lex Malsawma

May 29, 2003

MATTHEW SMITH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800